**IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF MISSISSIPPI
NORTHERN DIVISION**

MISSISSIPPI STATE CONFERENCE OF THE NATIONAL
ASSOCIATION FOR THE ADVANCEMENT OF COLORED
PEOPLE; DR. ANDREA WESLEY; DR. JOSEPH WESLEY;
ROBERT EVANS; GARY FREDERICKS; PAMELA
HAMNER; BARBARA FINN; OTHO BARNES;
SHIRLINDA ROBERTSON; SANDRA SMITH; DEBORAH
HULITT; RODESTA TUMBLIN; DR. KIA JONES;
MARCELEAN ARRINGTON; VICTORIA ROBERTSON,

Plaintiffs,

vs.

STATE BOARD OF ELECTION COMMISSIONERS; TATE
REEVES, *in his official capacity as Governor of Mississippi;*
LYNN FITCH, *in her official capacity as Attorney General of
Mississippi;* MICHAEL WATSON, *in his official capacity as
Secretary of State of Mississippi,*

Defendants,
AND

MISSISSIPPI REPUBLICAN EXECUTIVE COMMITTEE,

Intervenor-Defendant

**CIVIL ACTION NO.
3:22-cv-734-DPJ-HSO-
LHS**

AMENDED REBUTTAL REPORT OF DR. JORDAN RAGUSA

[1] Scope of Engagement

I was asked by Plaintiffs' counsel to respond to the report of Dr. Thomas Brunell, an expert for the defendants in this matter. Dr. Brunell's report evaluates the methodologies used in my analysis of Mississippi's redrawn districts. He concludes that my modeling strategy is "fatally flawed" and thus it offers "no evidence of racial predominance" (pg. 3). I respond to these charges in this report.

I am retained at the rate of $250 per hour. My compensation does not depend on the results of the case, or on the opinions and testimony I may provide. Any opinions expressed in this report are solely my own and do not represent the opinions of my employer.

[2] Opinions

It should be noted at the outset that Dr. Brunell offers no opinions on the question of whether race was a factor in the composition of the challenged districts. Dr. Brunell's report is instead focused on critiquing the methodologies used in my analyses. And yet Dr. Brunell never evaluates the validity of his own critiques, nor does he explain why the alternative methodologies he proposes might yield different results.

Dr. Brunell first claims that the BVAP changes in the five challenged districts are unremarkable. He also dismisses the mere possibility of racial gerrymandering in districts with a BVAP less than majority-minority, citing no evidence or offering no explanation. I provide data and discuss a peer-reviewed study that indicates otherwise.

Dr. Brunell also criticizes the use of Census blocks in my study even though precinct splits—which require an examination of data at the block level—are quite common in the enacted House and Senate plans.

Dr. Brunell next claims that the only way to evaluate the challenged districts is to catalog the considerations that only exist in the minds of mapmakers. He admits that this type of analysis is impossible to perform. I explain why an analysis like this would nonetheless contain obvious flaws.

Dr. Brunell then critiques one aspect of my analysis, the county envelope, arguing that it is simultaneously overinclusive and underinclusive. I evaluate these charges with a series of robustness checks, and these new analyses refute Dr. Brunell's claims and confirm the conclusions in my prior report. At the same time, Dr. Brunell fails to acknowledge that considerable evidence of racial gerrymandering in my report comes from a separate analysis that does not rely on the county envelope.

Dr. Brunell also claims that my analysis fails to consider compactness and contiguity. Neither of these charges is true. I provide data indicating that my border variable properly accounts for both factors.

Finally, Dr. Brunell misinterprets my findings, claiming that the statistical results provide no evidence of racial gerrymandering. I explain why this conclusion likely results from his misunderstanding of the design of my three analyses.

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[3] BVAP Changes

Dr. Brunell makes two claims about the Black voting age population (BVAP) in the five districts that Plaintiffs claim to be racial gerrymanders. First, Dr. Brunell dismisses the mere possibility of racial gerrymandering in districts with a BVAP below 50%. He claims without evidence or explanation that "we would usually expect to find [racial gerrymandering] in those districts that are majority-minority or nearly so" (pg. 4). Second, Dr. Brunell contends that the BVAP changes in the challenged districts are unremarkable because "we would not expect every single legislative district in the state to be well balanced in terms of the races or population moved in or out" (pg. 5).

On the second claim, it is true that modest changes in the racial composition of the 174 House and Senate districts were unavoidable to a degree. As Dr. Brunell notes, we would expect some districts to have their BVAP increase, and others to have their BVAP decrease. However, that does not mean that every change is insignificant by default. First, the changes in the challenged are actually quite large in magnitude, a point confirmed by the data in Figure 1 below. Second, seemingly small changes in the racial composition of a district can have a large effect on election outcomes. As explained below, this is especially true in districts like the challenged ones with a BVAP between 35% and 55%.

Figure 1 is a histogram of every district's BVAP change under the enacted plan. Values on the right of the x-axis, above 0%, indicate a BVAP increase while values on the left of the x-axis, below 0%, indicate a BVAP decrease. Each bar represents a 1% change in either direction, with higher bars on the y-axis revealing a greater number of districts in each increment. In simple terms, the histogram helps us see the extent to which the BVAP of all 174 districts changed because of the enacted plan.

Figure 1: BVAP Change (House and Senate)

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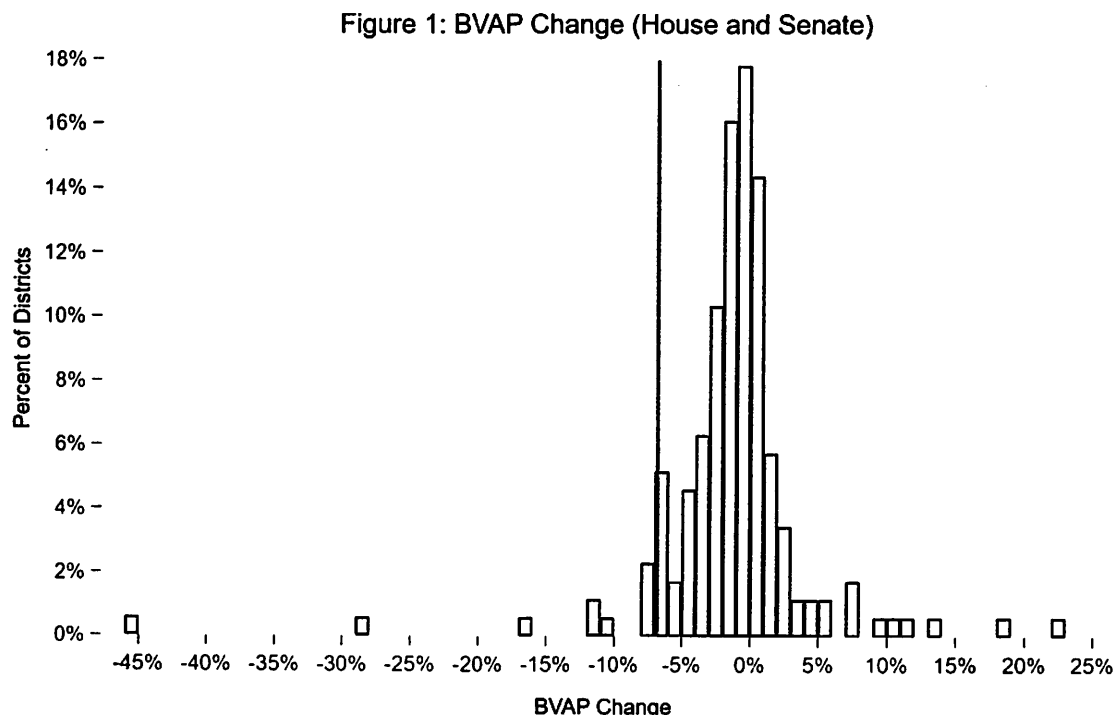
In the figure we can see a pronounced "peak" in the middle of the distribution consisting of three large clusters, the largest (17.8%) being districts with a BVAP reduction of 1% or less. On the other side of zero, 13.8% of districts experienced a BVAP increase of 1% or less. In total, roughly a third of all districts saw a 1% or less BVAP change in either direction. Furthermore, 54.0% of districts in the state had a 2% or less BVAP change in either direction, while 81.0% saw a 5% or less BVAP change in either direction.

Critically, the red line is the challenged district with the least extreme BVAP reduction. In other words, the red line indicates the position of SD #2 (-6.8% BVAP) and the four remaining challenged districts are in bars to the left. We can therefore see that the five challenged districts sit in the left "tail" of the distribution, far removed from the bulk of the districts. In total, 118 districts (out of 174) had a BVAP reduction under the enacted plans. SD #2 ranks as the 13th largest BVAP reduction in the state, followed by SD #48 at 12th (-6.9%), HD #64 at 11th (-6.9%), HD #22 at 9th (-7.2%), and HD #34 at 2nd (-28.9%). All in all, while it is true, as Dr. Brunell claims, that *some* districts would experience a BVAP increase and others a BVAP reduction, the magnitude of the reduction in the five challenged districts is unusually large when compared to the statewide changes.

Dr. Brunell offers no explanation, citation, or evidence to support his other contention about the BVAP changes: that racial gerrymandering is most likely to occur in majority-minority districts. I believe the opposite is more likely to be true; districts with a BVAP well under 50% are prime targets for racial gerrymandering.

As a starting point, it is worth noting that racial gerrymandering is an effort to limit the ability of Black voters to elect a candidate of their choosing, and one way to achieve this is to reduce the number of Black voters in a district. Although it is certainly possible to do so in a majority-minority district, there is an obvious challenge: the larger the district's BVAP, the more extreme the change needed to achieve the desired result. By comparison, it is far easier to alter the balance of power in a modestly competitive district with a BVAP below majority-minority.

As an example, consider SD #24, which had a BVAP of 77% prior to redistricting. According to Dr. Brunell, SD #24 is a logical candidate from a racial gerrymandering standpoint. But while the enacted plan indeed reduced the district's BVAP by 12%, the fourth largest decline in either chamber, the district is very likely to continue electing a Black candidate of choice over the next decade because the BVAP remains well above 50%. Indeed, in the November 2023 election, David Jordan, a Black Democrat, won reelection overwhelmingly. An effective gerrymander in SD #24—like other districts with large Black majorities—would require major changes that would naturally raise questions.

Unlike SD #24, and contrary to Dr. Brunell's claim, a racial gerrymander is more likely to alter future election outcomes—and draw less scrutiny—when the district's BVAP is less than majority-minority prior to redistricting. In such a district, seemingly small changes in the district's racial composition may have a large effect on the probability that Black voters elect a candidate of their choosing.

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A recently published article by Hicks et al. (2018) confirms the above.[1] Hicks and his coauthors examine the factors that explain whether a district elects a Black lawmaker. From 2013-2015, the most recent period they examine, Hicks et al. show that the probability of electing a Black lawmaker reaches 50/50 in the Deep South when the BVAP is in the 48-49% range. In other words, elections are most competitive for Black candidates in states like Mississippi when the BVAP is *less* than majority-minority. Furthermore, Hicks et al. show that the BVAP needed to reach the 50/50 threshold declined by 6% in the decade prior to 2013-15. If this trend continued over the subsequent decade, that is, up to the 2023 election, the BVAP needed to reach 50/50 would be 43% today, far less than majority-minority and approximately that of the challenged districts.

It is also worth mentioning that the Hicks et al. (2018) article finds that the relationship between a district's BVAP and the probability of electing a Black lawmaker is non-linear. Specifically, they show that modest changes in a district's racial composition have the greatest effect during the study period (2013-15) when the BVAP is between 35% and 55%.[2] In other words, the greatest "return" on a racial gerrymander occurs in this range. Outside this 35%-55% interval, an equivalently sized BVAP change has little effect on the probability of electing a Black lawmaker.

In summary, the BVAP reduction in the challenged districts is not a trivial feature of the enacted plans. Instead, the magnitude of the changes is quite large when compared to statewide trends and occurred in districts that are likely targets for racial gerrymandering given the size of their Black population prior to redistricting (well under majority-minority). In districts like the challenged ones, modest demographic changes can be especially consequential to electing Black candidates of choice.

[4] Census Blocks and VTD Splits

Dr. Brunell also criticizes the use of Census blocks in my analysis. He claims that my approach ignores the practical realities of redistricting, arguing that Mississippi's districts "were drawn based on precincts and not Census blocks" (pg. 5).

As elsewhere in his report, Dr. Brunell offers no explanation or basis for this sweeping claim. In my experience it is highly unlikely that Mississippi's mapmakers focused on precincts, and only precincts, when drafting the enacted plan. Indeed, redistricting plans often split precincts (requiring the use of Census block data) because it is very difficult or even impossible to draw two complete legislative maps, consisting of 122 House districts and 52 Senate districts, with only whole precincts.

By my count, the House enacted plan split 255 precincts.[3] Furthermore, every House district in the state except for eight (93%) contains at least one split precinct under the enacted plan. On the Senate side there are 41 precinct splits and well over half of Senate districts (58%) have at least one split precinct.[4] All in all: precinct splits are relatively common both enacted plans, making Census

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[1] See the article "Revisiting Majority-Minority Districts and Black Representation" by Hicks, Klarner, McKee, and Smith in the journal *Political Research Quarterly* (2018, Vol. 71).
[2] See figure 4 on page 418 of the Hicks et al. (2018) study.
[3] If we exclude split portions that have no population, the number declines to 235.
[4] If we exclude split portions that have no population, the number declines to 37.

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blocks a more precise and necessary unit of analysis. Dr. Brunell admits that in cases where precincts are split "a block-level analysis would be appropriate" (pg. 6).

An examination of Census blocks takes on extra significance when there is evidence that precincts are split along racial lines. My report shows exactly this; precinct splits were racially disproportionate in the five challenged districts. In other words, the data show a statistically significant pattern whereby precinct splits systematically excluded Black voters from the challenged districts (see pages 26-28 in my report). I think it is telling that Dr. Brunell *does not rebut this evidence* and instead critiques the mere analysis of Census blocks.

[5] Mapmakers' Considerations

Dr. Brunell next claims that my analysis is flawed because it fails to examine the changes mapmakers considered during redistricting but ultimately did not adopt. He writes:

> In order for Prof. Ragusa's analysis on racial predominance to be legitimate his statistical model needs to include all precincts that the map-makers considered to put in each district and exclude all precincts that the map-makers did not consider including in each and every district. This is, of course, impossible to do. (Brunell report, pg. 5)

As an empirical matter, Dr. Brunell admits that this type of analysis is impossible to perform. It is not an exaggeration: Dr. Brunell's considerations methodology requires data that only exists in the minds of the mapmakers. Although researchers could try to catalog their considerations based on public meeting transcripts, committee hearings, and alternative maps, these data sources suffer from obvious flaws. First, they may be an incomplete record of the changes that were contemplated during a lengthy redistricting process. Second, lawmakers may obfuscate their true motivations in some circumstances, and thus researchers have no way of knowing which considerations were sincere. And third, Dr. Brunell does not explain whose considerations represent the proper unit of analysis: the person(s) who quite literally drew the map, members of the state's redistricting committee, legislative staff, all 174 members of the state House and Senate, or some combination of these persons.

Dr. Brunell raises the same issue throughout his report, citing various factors that mapmakers may (or may not) consider when changing a district's boundaries. At one point he faults my analysis for failing to control for a hypothetical incumbent's "mother's house, their lake house, their grandchildren's preschool" and host a of other idiosyncratic factors (pg. 8). Dr. Brunell again admits that researchers "cannot account for these unique requests" (pg. 8). Indeed, he offers no evidence of such "unique requests" that factored into the design of Mississippi's challenged districts.

Let's imagine it were possible to perform Dr. Brunell's analysis. Doing so would contain an obvious flaw: mapmakers can engage in racial gerrymandering by *not* considering certain areas for the redrawn district. In this respect, Dr. Brunell's proposed methodology would treat mapmakers' decisions as a given and require us to disregard relevant data regarding the choices that were available to them. A simple example illustrates this point.

Say a district needs to add 5,000 persons to reach an ideal population size of 25,000. Assume also that the district has a BVAP of 40%, making it somewhat likely to elect a Black lawmaker (based on

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the Hicks et al. 2018 study cited above). On the western border within the same county is a cluster of densely populated blocks with a BVAP of 60% totaling exactly 5,000 persons. Adding these blocks would increase the district's BVAP to 44% making it likely to elect a Black lawmaker (e.g. Hicks et al. 2018). Imagine, however, that mapmakers restricted their focus to the east, ultimately selecting a cluster of blocks in a new county. Assume also that these blocks have a BVAP of 10%. In so doing mapmakers would reduce the district's BVAP by 6%, from 40% down to 34%, making it substantially less likely to elect a Black lawmaker (e.g. Hicks et al. 2018). Dr. Brunell's preferred methodology would have us ignore clear evidence of racial gerrymandering simply because mapmakers never "considered" the alternative that would have increased the BVAP.

In summary, Dr. Brunell's considerations critique proposes a standard that he admits is impossible. It isn't hyperbole to say that his critique would invalidate virtually all circumstantial evidence of racial gerrymandering. In this respect, he is asking us to ignore arguably the most relevant evidence—the choices that were available to mapmakers—and instead prioritize what mapmakers choose to reveal to the public.

[6] County Envelope

My analysis examines the choices available to mapmakers. It is based on two statistical models. Model #2 analyzes the blocks that were removed from the benchmark district. In this analysis, the population consists of every block in the district as it was drawn prior to redistricting. Notably, Dr. Brunell does not critique this analysis, which does not rely on the county envelope. Model #1 examines the opposite: blocks that were added to redrawn district. In this analysis, the population consists of every block within the county envelope around the benchmark district. In other words, Model #1 focuses on the blocks outside the district but within the same county or group of counties. I note in my report that this methodology complies with traditional redistricting principles in several ways. I write:

> First, because blocks in the county envelope are often within a dozen miles of the district, this analysis examines choices that may limit the number of political subdivision splits, most notably county splits, and could produce compact and contiguous districts. Second, given their geographic proximity to one another, county envelope blocks often share social, economic, political, and other characteristics in common. In this respect, blocks in the county envelope may be logical choices for inclusion from a communities of interest standpoint. (Ragusa report, pg. 6)

It is worth noting that this approach was developed by Dr. Stephen Ansolabehere, Dr. James Snyder, and Dr. Charles Stewart III in a peer reviewed journal article that has been cited over 500 times.[5] Furthermore, this methodology was used by Dr. Ansolabehere in *Cooper v. Harris* (2017) and Dr. Max Palmer in *Bethune-Hill vs. Virginia State Board of Elections* (2017).

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[5] See the article "Old Voters, New Voters, and the Personal Vote" by Ansolabehere, Snyder, and Stewart III in the journal *American Journal of Political Science* (2000, Vol. 44).

I provide a visual example of the county envelope in Figure 2 on the next page.[6] In the figure we can see the envelope for HD #22. Purple areas are those that comprise HD #22 under both the benchmark plan and the enacted plan (e.g. they were kept in the district). Areas shaded blue were in the district under the benchmark plan but were drawn out by the enacted plan. Areas shaded red are those that were drawn into the district, while gray areas are those within the county envelope that were not drawn into the district. Finally, darker areas reveal a larger Black voting age population at the Census block level.[7] I include the same county envelope maps for each of the five challenged districts in the appendix, including maps for the robustness checks in the next section.[8]

We can see that HD #22 was whole within Chickasaw County and occupied a large portion of Pontotoc County under the benchmark plan. Consistent with traditional redistricting principles (namely, compactness and respecting county boundaries) my analysis examines the choices available to mapmakers in Pontotoc to the north. Mapmakers instead removed portions of both counties, which created a new county split in Chickasaw, and then drew the district to the east into Monroe, creating a third county split. In my analysis, Model #1, based on the county envelope, asks why mapmakers bypassed the available envelope in Pontotoc (the gray areas) and instead drew the district into a new county to the east (the red areas). Model #2, by comparison, asks why mapmakers removed the selected parts of Chickasaw and Pontotoc (the blue areas) and not other portions of the benchmark district.

Figure 2: County Envelope for HD #22

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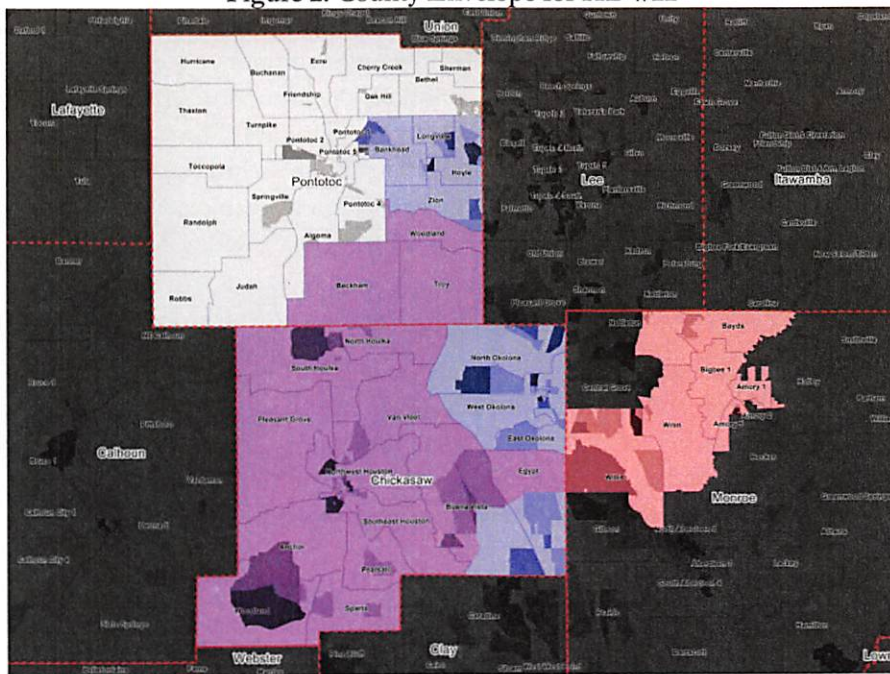
[6] At my request, ACLU staff working at the direction of counsel created and provided this map to me based on the parameters of my envelope.
[7] Specifically, the lowest gradation indicates 0-20 Black residents of voting age while the darkest indicates 80 or more Black residents of voting age. Each shade in between is in an increment of 20.
[8] Like the HD #22 example, these envelope maps were created and provided to me by ACLU staff working at the direction of counsel.

Dr. Brunell is critical of the county envelope. He offers two primary critiques: in some cases, the county envelope is too narrow, and in other cases, the county envelope is too broad. In this respect he faults the envelope for being simultaneously underinclusive and overinclusive. He writes that "If [Dr. Ragusa] includes any precincts that were not actually considered to be put in a district, or if he excludes any precincts that were considered for inclusion in the district, then all his results are invalid" (pg. 6).

Dr. Brunell supports his critique with data on the districts that saw their county envelope change under the enacted plan. He claims that "over 30 districts changed county composition in the remapping for Mississippi" (pg. 6). He therefore believes the envelope may not accurately reflect the county(s) mapmakers considered. As noted in the prior section, it is deeply flawed to place such emphasis on mapmakers' considerations and ignore that choices that were available to them. Nevertheless, Dr. Brunell's own data validate the accuracy of the county envelope.

Looking at Table 1 in his report, the exact number of House districts that changed their county composition is 36 (see pgs. 20-21). With 122 House districts, that means 86 did *not* see their envelope change. In other words, the county envelope comports with how Mississippi's mapmakers redrew the districts in over 70% of cases.[9] We should not be surprised by this: once again, the envelope is based on traditional redistricting principles. Dr. Brunell does say that my analysis may contain "some decent guesses by including all precincts in the county or counties that each new district encompassed" (pg. 5). I think this is an understatement; his own data indicate that my approach is hardly "guessing" and that its accuracy is far better than "decent."

A change in the county envelope can occur in two ways. First, mapmakers may extend the district into an entirely new county. Although my modeling strategy, relying on the county envelope, includes these newly added blocks in the analysis, it does not include the entirety of the new county (i.e. the blocks that were not selected). Dr. Brunell would likely object that the envelope is too narrow, or underinclusive, in these cases for not adding the entire county.

I disagree with this critique for two principal reasons. First, the drawing of a district into a new county is a somewhat rare occurrence. Breaking down Dr. Brunell's data even further, only 25 districts listed in his Table 1 were drawn into a new county (see pgs. 20-21). With 122 House districts, that means 80% were kept in the same county(s). Second, in most cases mapmakers drew the district into a tiny portion of the new county (i.e. just across the border). In these cases, Dr. Brunell's other critique would almost certainly apply: including the entirety of the new county would be too broad. An example would be SD #48, which was added to a tiny portion of southeastern Hancock County. In my original report for SD #48, the county envelope included the new blocks in Hanock but not the rest of the county.

Second, mapmakers may change the county configuration by removing a district from a county entirely. As noted above, this scenario is examined in Model #2, the analysis of blocks drawn out of the district. Because that analysis does not utilize the county envelope, instead analyzing the

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[9] Dr. Brunell does not list the same changes in county composition for the Mississippi Senate.

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population within the benchmark district, Dr. Brunell's critiques do not apply. In this respect, his charges do not undermine the evidence of racial gerrymandering in HD #22, SD #2, and SD #48.

Dr. Brunell also claims that the county envelope can be too broad in some instances. He cites as an example HD #52 and DeSoto County.[10] He notes that under the benchmark plan, HD #52 was on the eastern edge of DeSoto County and that there are four districts between HD #52 and the county's western border (see pg. 8). In other words, he believes the county envelope for HD #52 is overinclusive; that is, it contains blocks that are too geographically removed from the district border.

I disagree with this critique for two reasons. First, there are examples in the enacted plan where mapmakers did what Dr. Brunell criticizes: crossing from one edge of the county to the other, grabbing portions of multiple districts in the process. For example, under the benchmark plan, HD #34 occupied the southwest part of Grenada County. Under the enacted plan, the district was extended to both the eastern and northern edge of the county line, and then even further north to occupy the entirety of Yalobusha County and a tiny part of Lafayette County. In the process, HD #34 added portions of four districts: HD #46, HD #23, HD #33, HD #10. Second, and relatedly, my statistical analysis includes a variable for whether the block is on the border of the district. In other words, Dr. Brunell's critique about geographic proximity is explicitly taken into consideration in my analysis.

[7] Robustness Checks

Although I disagree with Dr. Brunell's county envelope critiques, I nevertheless perform a series of new analyses to determine whether his claims have any basis. I do so with robustness checks that reevaluate Model #1 for the challenged districts. A robustness check is a type of secondary analysis where the researcher tweaks aspects of their modeling strategy to ascertain whether the results change. At issue in this section is whether altering the county envelope changes my conclusions regarding racial gerrymandering in the five challenged districts.

I wish to make three points before proceeding to the new results. First, one advantage of the county envelope (relative to what Dr. Brunell proposes) is its consistency and evenhandedness. Namely, my analysis applies the county envelope in a standardized manner to every district. It would almost certainly raise objections if my methodology ignored traditional redistricting principles and instead relied on my own judgment about what mapmakers should consider for each district. Second, it is worth noting that Dr. Brunell did not perform these analyses even though he has the requisite skills and, presumably, access to my data and statistical code.[11] In some cases, the robustness check involves changing a few lines of code, which is to say they take minutes to run. Lastly, Dr. Brunell never explains whether (or why) my results would change once we tweak parameters of the county envelope. It is quite likely that these alterations, some of which are very modest, do not change the results or conclusions. I show this below.

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[10] HD #52 is not one of the five challenged districts. As noted below, among the challenge districts this critique best applies to HD #64.
[11] I provided my raw data and programming code to plaintiffs' attorneys, and I presume they supplied it to defense counsel who then provided it to Dr. Brunell.

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HD #22

Regarding HD #22, my report showed that race was a significant factor in the blocks drawn out of the district. Because this finding is based on Model #2, Dr. Brunell's county envelope critiques do not apply. As noted earlier, Dr. Brunell does not challenge Model #2 specifically. I performed a robustness check nonetheless.

HD #22 occupied two counties prior to redistricting: Chickasaw and Pontotoc. It occupies the same two counties under the enacted plan but added a large portion of a third county: Monroe. In fact, all of HD #22's additions came from Monroe and the district now occupies what looks to be 1/5th of the county. Dr. Brunell would likely object that the envelope is too narrow because it fails to include the entirety of the new county, which mapmakers clearly considered for the redrawn district. I therefore added Monroe County to the HD #22 envelope, in addition to Chickasaw and Pontotoc, thus including blocks that were not added in the redrawn district.[12]

According to the revised analysis for HD #22, when we include Monroe in the envelope, the results indicate that race was a significant factor in the blocks added to the district. In particular, the negative and statistically significant BVAP variable in Table 1 indicates that Black voters were significantly less likely to be moved into the redrawn district. Notably, the same analysis in my prior report (without Monroe) yielded an insignificant BVAP variable. In other words, the robustness check based on Dr. Brunell's critique provides *additional* evidence of racial gerrymandering. Because there are no other changes to the analysis, the explanation for this new result is that the additions to HD #22 from Monroe County have a lower BVAP compared to the blocks that were not chosen.

I once again conclude that race was a significant factor in the composition of the redrawn HD #22. According to the results, Black voters were significantly less likely to be moved into the redrawn district and significantly more likely to be drawn out of the district. As noted in my report, these findings exist even when controlling for a host of closely related explanations for the district's configuration (most notably partisan gerrymandering) and various other datapoints validate the multivariate results (for example, the roughly 7% BVAP reduction).

Table 1: HD #22 Robustness Check	
	Model 1
Variables	Moved In
BVAP	-0.23**
Trump Vote	-0.85***
Total VAP	0.42***
Border Block	0.02
Constant	-1.87***
N	2,085

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

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[12] As a reminder, my analysis analyzed every block that was added to the redrawn district, including those that were added from a county outside the envelope. I did not, however, include blocks outside the redrawn district in thew new county on the grounds these blocks are typically far removed from the added portions.

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HD #34

HD #34 was among the most heavily redrawn districts this cycle. As noted in my report, the enacted plan maintains just 27% of the benchmark population, a change that occurred once HD #33 was moved to the southeastern part of the state. HD #34 occupied five counties prior to redistricting. Under the enacted plan, the district was removed from Holmes, Leflore, and Tallahatchie, remains in Carroll and Grenada, and was drawn into Lafayette and Yalobusha. It is also notable that the redrawn district occupies a tiny portion of Carroll and Lafayette counties. In Carroll, the district consists of one precinct, and in Lafayette, the district contains one whole precinct and two split precincts. According to my data, 93% of the district's population under the enacted plan resides in Grenada and Yalobusha.

Dr. Brunell would no doubt argue that the county envelope is too broad for including the three counties the district no longer occupies: Holmes, Leflore, and Tallahatchie.[13] At the same time, he might object to including the entirety of Carroll and Lafayette given that the district occupies such a tiny portion of these two counties. I therefore conducted the robustness check by restricting the analysis to Grenada and Yalobusha counties.[14]

According to the revised analysis for HD #34, even when we restrict the analysis to Grenada and Yalobusha, we again find that race was a significant factor in the blocks added to the redrawn district. Like my original analysis, the negative and statistically significant BVAP variable in Table 2 indicates that Black voters were significantly less likely to be moved into the redrawn district. In other words, the robustness check based on Dr. Brunell's critiques provides the same evidence of racial gerrymandering.

I once again conclude that race was a significant factor in the composition of the redrawn HD #34. According to the results, Black voters were significantly less likely to be moved into the redrawn district. As noted in my report, these findings exist even when controlling for a host of closely related explanations for the district's configuration (most notably partisan gerrymandering) and various other datapoints validate the multivariate results (for example, the nearly 30% BVAP reduction).

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[13] For reasons articulated elsewhere, I would counter that these are relevant choices to analyze. In cases like HD #34, my analysis asks why mapmakers decided to abandon these three counties in favor of the two that were added to the redrawn district.

[14] I conducted a second robustness check where the model was restricted to Grenada and Yalobusha but also included the tiny portions added from Carroll and Lafayette. I report these results in Table 2 as well. It shows the exact same results.

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Table 2: HD #34 Robustness Check

	Model 1 Moved In	
Variables	Robustness #1	Robustness #2
BVAP	-0.36**	-0.35**
Trump Vote	0.82***	0.93***
Total VAP	-0.19	-0.24
Border Block	-6.66***	-6.89***
Constant	7.40***	7.68***
N	803	879

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

HD #64

HD #64 occupied two counties prior to redistricting: Hinds and Madison. It occupies the same two under the enacted plan, so the county envelope includes every block that was added to the redrawn district. However, HD #64 resides in the northeast corner of Hinds and the southern tip of Madison. Dr. Brunell would likely object that the envelope is too broad in this instance. Indeed, he objected to HD #52 in DeSoto County on essentially the same grounds.

According to my data, every block added to HD #64 was on the border of the benchmark district.[15] I therefore conducted the robustness check by restricting the analysis to these border blocks. In essence, this narrows the envelope's geographic scope substantially, restricting the focus to blocks within a few miles of the benchmark district. In my original analysis there were 5,062 blocks in the county envelope outside HD #64. Because only 693 are along the border, the revised analysis discards 86% of the data under examination.[16]

Looking at the new results for HD #64, even when restricting the analysis to the border of the benchmark district, we again find that race was a significant factor in the blocks added to the redrawn district. Like my original analysis, the negative and statistically significant BVAP variable in Table 3 indicates that Black voters were significantly less likely to be moved into the redrawn district. In other words, the robustness check based on Dr. Brunell's critique provides the same evidence of racial gerrymandering.

I once again conclude that race was a significant factor in the composition of the redrawn HD #64. According to the results, Black voters were significantly less likely to be moved into the redrawn district. As noted in my report, these findings exist even when controlling for a host of closely related explanations for the district's configuration (most notably partisan gerrymandering) and various other datapoints validate the multivariate results (for example, the roughly 7% BVAP reduction).

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[15] I define border blocks in my prior report, and this rebuttal, as those that are one precinct across the border from the benchmark district.

[16] My analysis is restricted to blocks with population. It is very likely that there are additional blocks (in the envelope and/or on the border) that have no population.

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Table 3: HD #64 Robustness Check	
	Model 1
Variables	Moved In
BVAP	-0.35***
Trump Vote	-0.15*
Total VAP	0.16***
Constant	-2.85***
N	693

*** p<0.01, ** p<0.05, * p<0.1

SD #2

Regarding SD #2, my report showed that race was a marginally significant factor in the blocks added to the redrawn district and a significant factor in the blocks removed from the redrawn district.[17] Because the latter finding regarding the blocks drawn out of the district comes from Model #2, Dr. Brunell's county envelope critique does not apply. As noted earlier, Dr. Brunell does not challenge Model #2 specifically. I therefore performed a robustness check for Model #1.

SD #2 occupied only one county prior to redistricting: DeSoto. It occupies only DeSoto after redistricting, so the county envelope includes every block that was added to the redrawn district. For this reason, Dr. Brunell's underinclusive critique is not reasonable, in my view. Further, SD #2 bordered every other district in DeSoto County under the benchmark plan: SD #1 and SD #19. For this reason, Dr. Brunell's overinclusive critique (based on HD #52 in DeSoto County) is not reasonable, either.

Dr. Brunell might object, however, that mapmakers mostly confined their additions to the area along the border of the benchmark district. According to my data, 92% of the blocks added to SD #2 and 93% of the new population came from the border just outside the benchmark district. Like HD #64 above, I therefore restricted the analysis to these border blocks.[18] In so doing, the sample size drops from 1,274 to 450.

According to the revised analysis for SD #2, even when restricting the analysis to the border of the benchmark district, we again find that race was a significant factor in the blocks added to the redrawn district. Like my original analysis, the negative and statistically significant BVAP variable in Table 4 indicates that Black voters were significantly less likely to be moved into the redrawn ⸳

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[17] As noted in a similar footnote in my report, this conclusion is based on a p-value of 0.07 on the BVAP variable in Model #1. Researchers often refer to a p-value between 0.10 and 0.05 as "marginal" statistical significance.

[18] Like the robustness check for HD #34, I conducted a second robustness check where I included every block added to the redrawn district, even those that were not along the border. I found the same results in this second robustness check and report these results in Table 4 as well. An alternative would be to define the envelope as two precincts removed from the benchmark district. Doing so would defeat the purpose and not follow Dr. Brunell's critique, however. Indeed, two precincts pushes the envelope all the way to the western edge of DeSoto County, which is the exact example Dr. Brunell cites when critiquing the county envelope.

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district. In other words, the robustness check based on Dr. Brunell's critique provides the same evidence of racial gerrymandering.

I once again conclude that race was a significant factor in the composition of the redrawn SD #2. According to the results, Black voters were significantly less likely to be moved into the redrawn district. As noted in my report, these findings exist even when controlling for a host of closely related explanations for the district's configuration (most notably partisan gerrymandering) and various other datapoints validate the multivariate results (for example, the roughly 7% BVAP reduction).

Table 4: SD #2 Robustness Check		
	Model 1 Moved In	
Variables	Robustness #1	Robustness #2
BVAP	-0.08**	-0.07**
Trump Vote	0.10**	0.10**
Constant	-0.23*	-0.17
N	436	450

*** p<0.01, ** p<0.05, * p<0.1

SD #48

Regarding SD #48, my report showed that race was a significant factor in the blocks added to the redrawn district and a significant factor in the blocks removed from the redrawn district. Because the latter finding regarding the blocks drawn out of the district comes from Model #2, Dr. Brunell's county envelope critique does not apply. As noted several times, Dr. Brunell does not challenge Model #2 specifically. I therefore performed a robustness check for Model #1.

SD #48 occupied one county prior to redistricting: Harrison. It continues to occupy Harrison County under the enacted plan but was drawn just across the border into a second county: Hancock. In Hancock County, SD #48 includes portions of Bay St. Louis and Waveland along the coast.

Dr. Brunell would likely object that the envelope is too narrow for failing to include Hancock County. He might also object that adding the entire county is too broad a geographic expanse. I therefore adjusted the envelope to include only those blocks on the border outside the district's new boundary within Hancock County.[19] In essence, this adds to the envelope the adjacent portions of Bay St. Louis and Waveland that were not selected for the redrawn district, a total of five precincts.

According to the revised analysis for SD #48, even when we expand the analysis to include additional portions of Hancock County, we again find that race was a significant factor in the blocks added to the redrawn district. Like my original analysis, the negative and statistically significant BVAP variable in Table 5 indicates that Black voters were significantly less likely to be moved into

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[19] It is worth reiterating that the county envelope already included any block drawn into a new county (just not the rest of the county). In other words, the envelope analyzed the new portions of Bay St. Louis and Waveland. My robustness check simply adds blocks on the border just outside these newly added areas. As in my prior report, as here, I define blocks on the border as those one precinct outside the district's boundary.

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the redrawn district. In other words, the robustness check based on Dr. Brunell's critiques provides the same evidence of racial gerrymandering.

I once again conclude that race was a significant factor in the composition of the redrawn SD #48. According to the results, Black voters were significantly less likely to be moved into the redrawn district. As noted in my report, these findings exist even when controlling for a host of closely related explanations for the district's configuration (most notably partisan gerrymandering) and various other datapoints validate the multivariate results (for example, the roughly 7% BVAP reduction).

Table 5: SD #48 Robustness Check	
	Model 1
Variables	Moved In
BVAP	-0.14**
Trump Vote	-0.11**
Border Block	-0.57***
Constant	-1.33***
N	2,667

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

[8] Compactness and Contiguity

Dr. Brunell next critiques my analysis for failing to consider compactness and contiguity. At one point he says my analysis "does not account for compactness or contiguity" (pg. 7) while later he claims, "there are no controls for the compactness of a district in his method" (pg. 8).

It is simply not true that my analysis fails to take into consideration these factors. In fact, Dr. Brunell admits that my design *does* include a control for compactness and contiguity; his argument is simply that my border variable is "not sufficient" (pg. 7). Instead, Dr. Brunell says he prefers a measure that counts the number of precincts from the border to the edge of the county envelope. Although this is certainly possible to perform, his measure would suffer from a couple limitations relative to my variable.

First, precincts do not come in a standard size; they can be geographically tiny and densely populated, geographically large and rural, or a combination of the two. Although this critique applies to my border variable as well, the problem would be magnified if we were to start combining multiple precincts into a single additive index. A precinct along the border, by comparison, is far more likely to maintain the district's basic shape under the benchmark plan and resemble precincts on the other side of the border but within the district. Second, my border variable identifies blocks that are contiguous to the district. Dr. Brunell's proposed count variable does not measure contiguity at all. It merely attempts to measure compactness.

An examination of the enacted plan validates that my border variable is a strict control for both compactness and contiguity. According to my data, 74% of the blocks that were added to the redrawn House districts and 60% of the blocks added to the redrawn Senate districts came from the

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border.[20] In this respect the border block variable accounts for a significant portion of the variation in which blocks were selected for the redrawn districts. Stated another way, the border variable is an accurate reflection of the redistricting process in Mississippi.

We can also look to the robustness checks for evidence that my border variable is working as it should. Recall that in the robustness check for HD #64 above, 86% of the cases are discarded when we restrict the analysis to blocks along the border. In this analysis, Dr. Brunell's compactness and contiguity critiques do not apply—every single block under examination would keep the district roughly as compact as it was prior to redistricting and every block is contiguous. I ultimately find the same result as my original analysis (which relies on the border block variable). If my analysis was fatally flawed, as Dr. Brunell claims, we would expect to find different results once we "properly" account for compactness and contiguity.

It should also be pointed out that my analysis accounts for compactness in another way: the county envelope. As noted in my original report, the blocks within the envelope are typically those that could be added to the redrawn district without significantly reconfiguring the district. Indeed, the envelopes reflect a set of choices that would typically keep the district roughly as compact as it was under the benchmark plan.

[9] Coefficients

At the end of his report, Dr. Brunell makes an attempt to summarize my statistical results. Citing the sign and significance of the coefficients, Dr. Brunell incorrectly states that "None of the five districts matches what we would expect from purposeful racial gerrymandering" (pg. 10). Dr. Brunell claims that the BVAP coefficient in Model #1 should have the same sign as the BVAP coefficient in Model #3, while Model #2 should have the opposite sign.[21] In this context, the coefficients tell us whether Black voters were more or less likely to be moved into/out of the redrawn district. Furthermore, Dr. Brunell believes all three coefficients need to be significant for there to be sufficient evidence of racial gerrymandering.

None of these claims are accurate. For starters, there is no mathematical basis for his view about the coefficient signs.[22] Because Model #1 and Model #2 are separate analyses, examining the "in" and "out" movement, respectively, nothing requires them to have opposite signs. Model #3,

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[20] I omitted HD #20 and HD #33 from the House calculation because they were moved to different parts of the state. Border additions were therefore impossible. I did the same for SD #36 in the Senate calculation.

[21] Dr. Brunell writes the following on page 10 of this report: "If the map-makers were trying to reduce the BVAP in a district, we would expect the BVAP coefficient in the three models to have the opposite signs (moved-in should be negative, moved-out should be positive, and moved in/kept in should be negative) and all of the coefficients should be statistically significant."

[22] As noted in my prior report, the number associated with BVAP coefficient does not have a straightforward interpretation nor can different coefficients be directly compared to one another. Because logistic regression uses a non-linear link function (i.e. a logit), the coefficient number represent the effect of a 1-unit change in the independent variable on the log odds of the outcome. I plot the effect of the BVAP variable in my prior report to ascertain its substantive significance. I do not do the same in this rebuttal report because my conclusions remain the same after performing the robustness checks.

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however, combines both models. Because Model #3 examines both changes simultaneously, it can have the same sign as either Model #1 or Model #2.

Dr. Brunell's claims are wrong for substantive reasons as well. He seems to think that mapmakers must gerrymander in both directions (simultaneously in and out) to achieve the desired outcome. Although it is certainly possible to move Black votes out of a district and then White voters back into the district, a gerrymander can also occur when the movement in one direction is substantially larger than the movement in the opposite direction. In fact, when a district is significantly over or under populated, mapmakers typically make the bulk of their changes in only one direction.

A simple example will demonstrate these points. Table 6, below, reproduces Table 1 for HD #22 in my prior report (see pg. 30). Looking at the results, we can see that the BVAP coefficient is positive for both Models #1 and #2. Model #1 indicates that Black voters were more likely to be moved into the district while Model #2 reveals that Black voters were more likely to be moved out of the district. Dr. Brunell seems to think that these results are contradictory and "offset" one another. Notice, however, that the positive BVAP coefficient in Model #1 is statistically *insignificant* whereas the positive BVAP coefficient in Model #2 is statistically *significant*. In lay terms, the results indicate that race was a reliable predictor of who was removed from the district but not a reliable predictor of who was moved into the district. A likely explanation for this pattern, confirmed by the raw data, is that mapmakers achieved a racial gerrymander in HD #22 by removing more Black voters from the district than they moved into the district.

Table 6: Analysis of HD #22 (reproduced from the original analysis)			
	Model 1	Model 2	Model 3
Variables	Moved In	Moved Out	Moved In/Kept In
BVAP	0.21	0.26**	-0.06
Trump Vote	-1.84***	-0.66**	-0.60***
Total VAP	0.76***	0.12	0.21***
Border Block	-1.04***	0.32	0.45***
Constant	-0.53***	-0.95***	-0.28***
N	999	828	1,827

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

A simple examination of the raw data confirms the multivariate results. First, Table 2 in my report (not included here) showed that 1,865 Black voters were drawn into HD #22, far fewer than the 3,186 Black voters who were drawn out of HD #22. Second, the same table in my report shows that the BVAP in HD #22 declined by 7% because of these changes. Dr. Brunell's report lists the exact same BVAP reduction.

All in all, Dr. Brunell is clearly wrong when he suggests that a positive coefficient in Model #1 (the in movement) and Model #2 (the out movement) suggests that racial gerrymandering did not occur in HD #22. He is also clearly wrong that the insignificant coefficient in Model #1 somehow invalidates my conclusions. Not only does this claim lack any basis in the design of my analysis, but it is also contradicted by the unrebutted raw data that even he cites.

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[10] Conclusions

As in my first report, I conclude that race was a significant factor in the design of the challenged districts. I hold this opinion to an even higher degree of certainty after performing the robustness checks in section seven. Once again, the evidence indicates that Black voters were excluded from the five challenged districts in a statistically significant fashion. I believe the results of these new analyses confirm that Dr. Brunell's critiques are unfounded.

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[11] Appendix

The following images in this Appendix reflect the county envelopes I used in my analyses. For comparison, I have included both the county envelopes I used in my original report, as well as the expanded county envelopes I used for the robustness checks in my rebuttal report. For HD #34 and SD #2, I performed two robustness checks, as described in footnotes 14 and 18; the modified envelope for each check is provided.

The red shading shows the district as it exists under the current enacted plan, while the blue shading shows the district as it existed under the benchmark plan (enacted after the 2010 redistricting cycle). Purple shading reflects the overlap between the blue benchmark district and the red enacted district.

The remaining gray areas are the parts of the county envelope that are not within either the enacted or benchmark districts.

The orange lines reflect county boundaries. Each county is sub-divided into precincts, whose names are shown.

Areas within the envelope are also shaded at the Census block level; darker shading indicates a higher number of Black persons of voting age in that Census block. The are five gradations of shading corresponding to 0-20 Black voting age individuals, 20-40 individuals, 40-60 individuals, 60-80 individuals, and 80+ individuals.
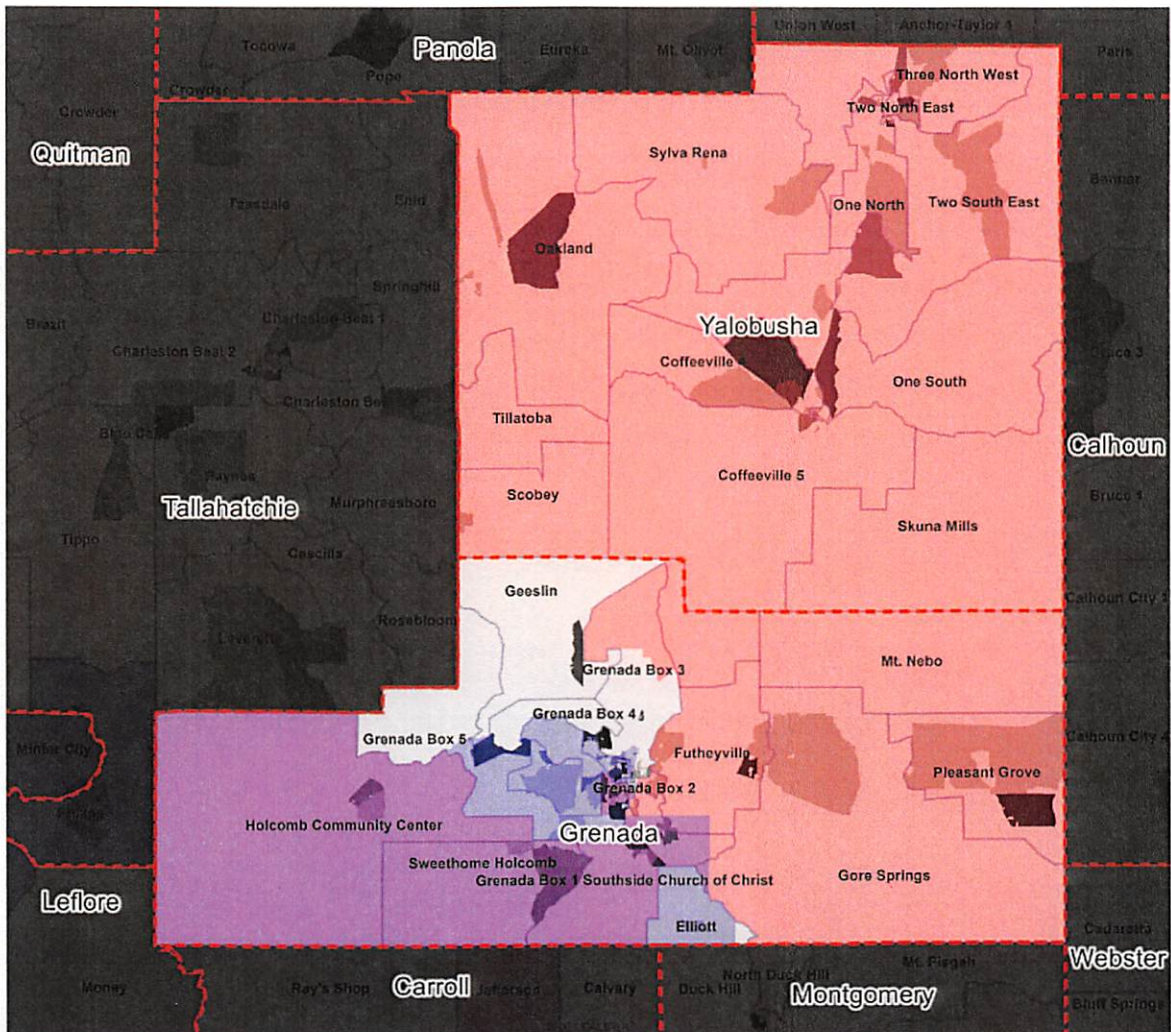
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HD #22 County Envelope (original report)
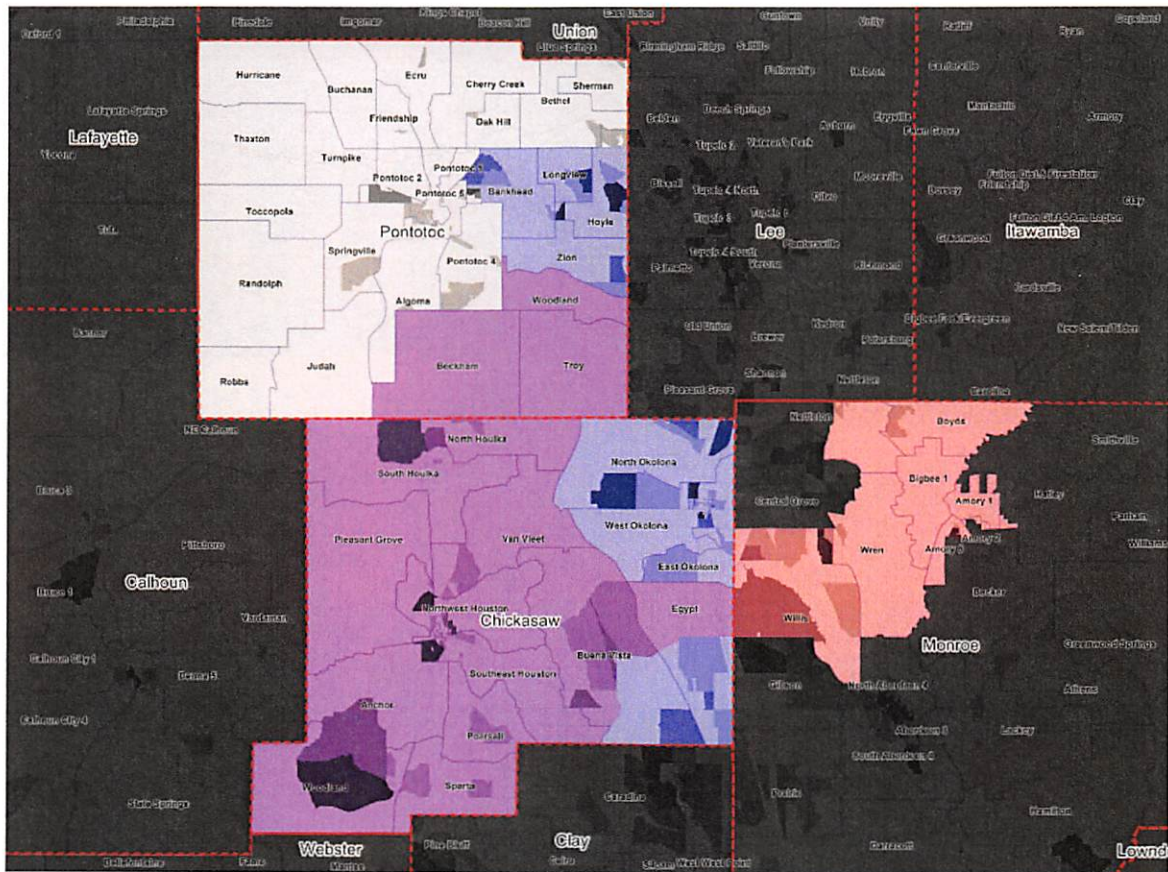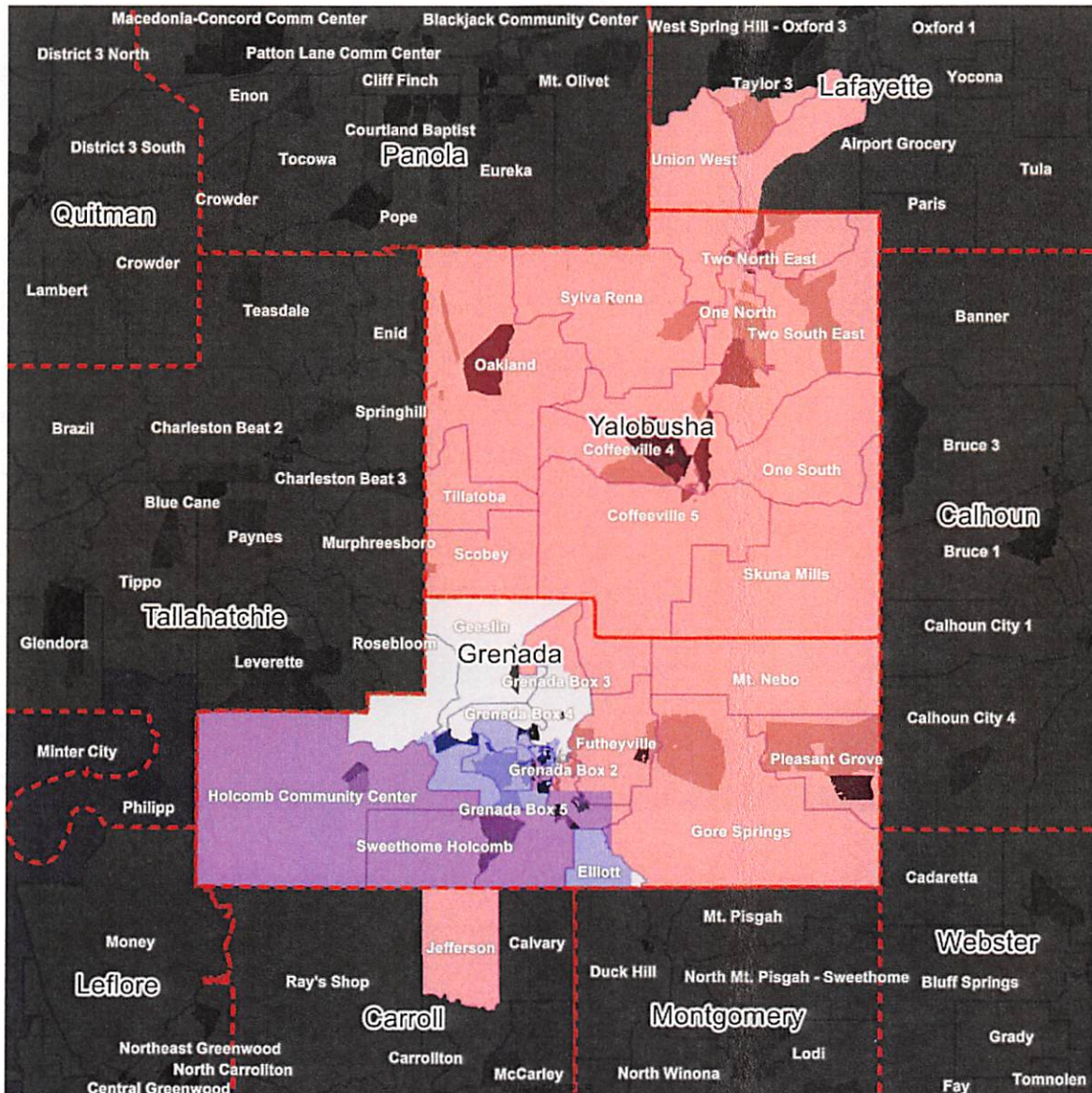
HD #22 County Envelope (robustness check)

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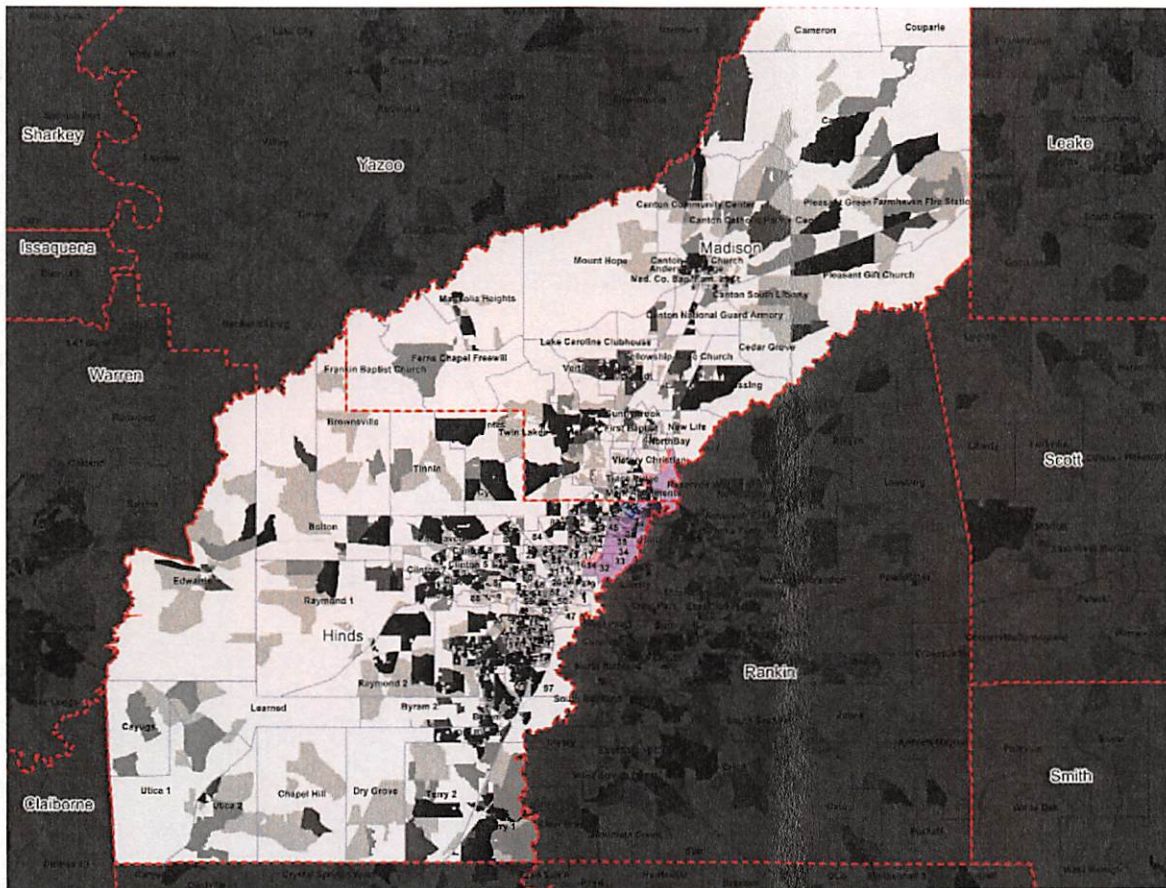HD #34 County Envelope (original report)

22
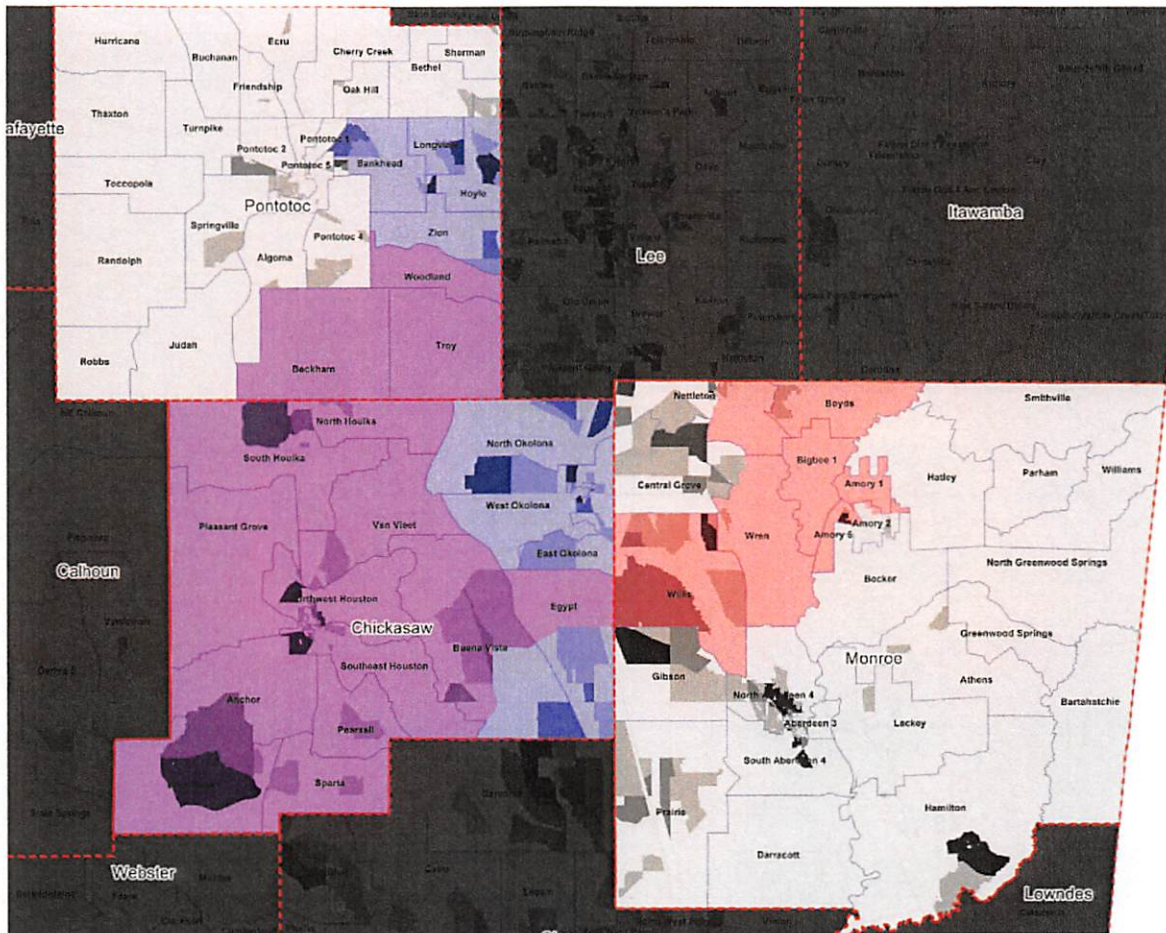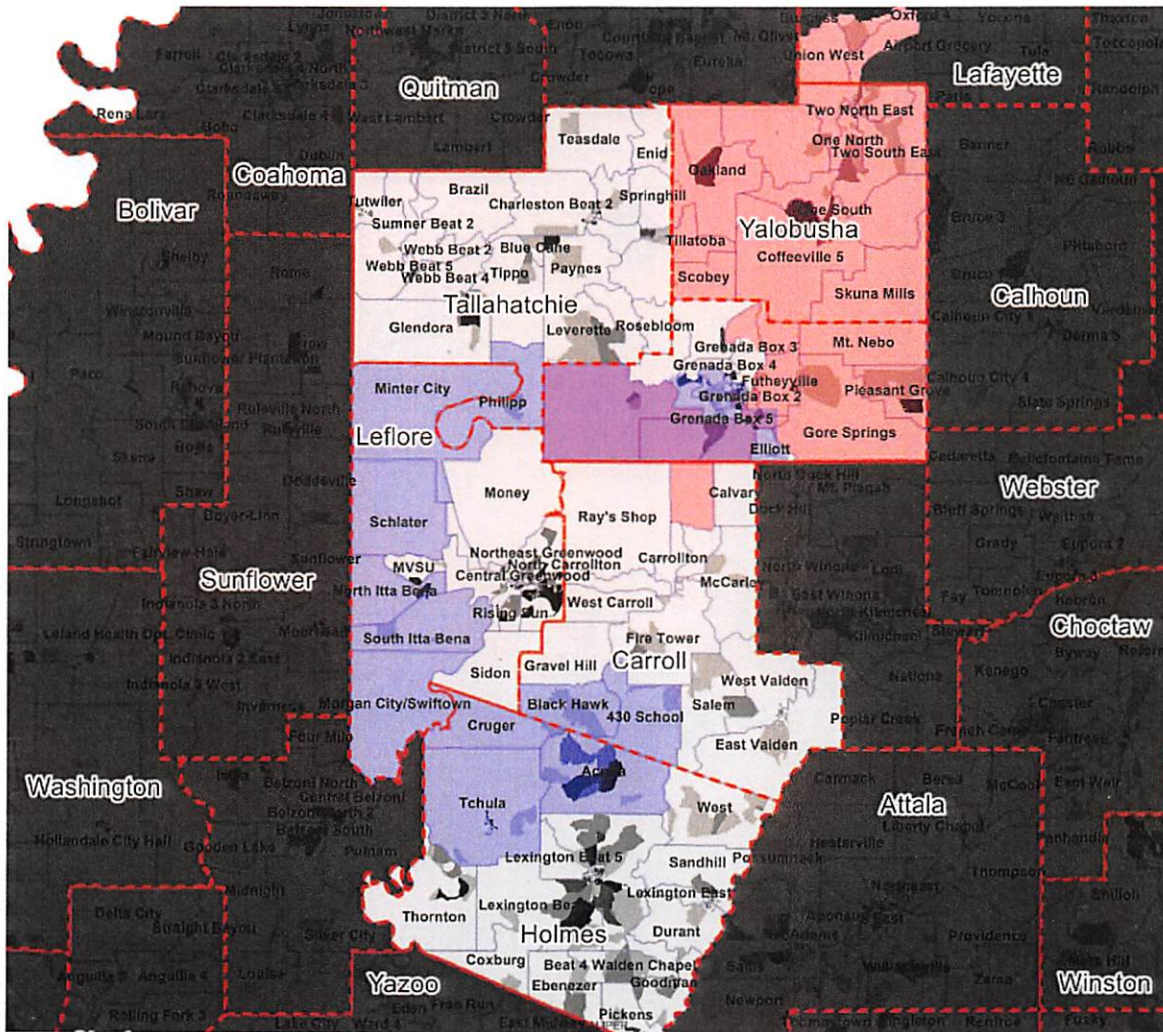
HD #34 County Envelope (first robustness check)
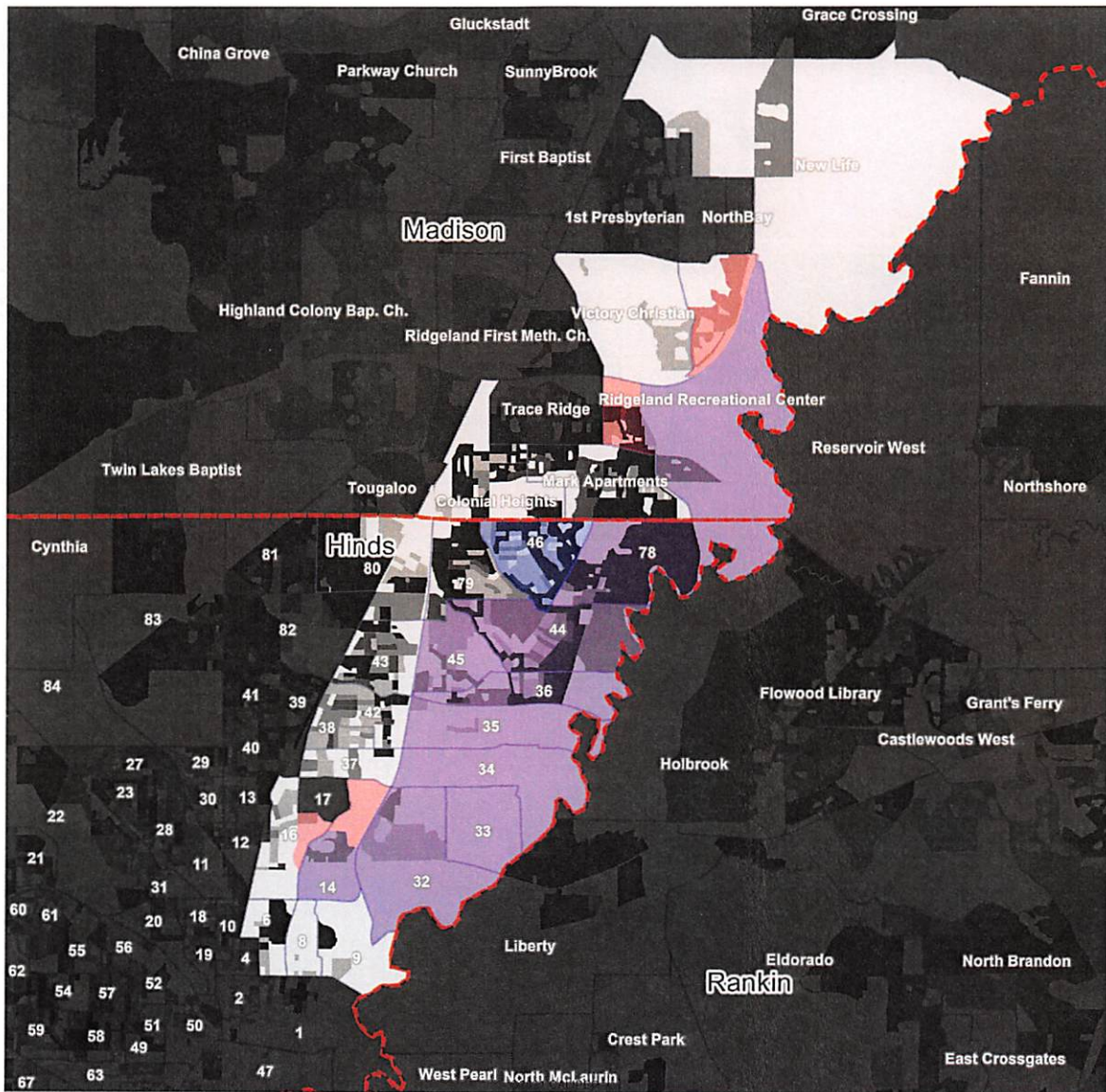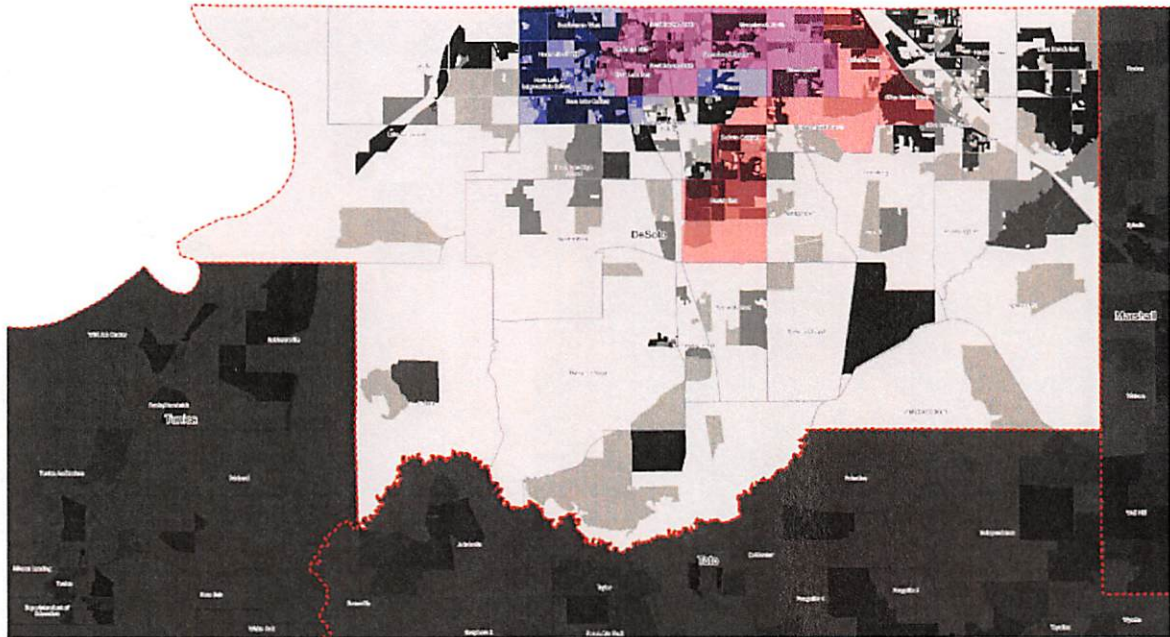

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HD #34 County Envelope (second robustness check)

HD #64 County Envelope (original report)
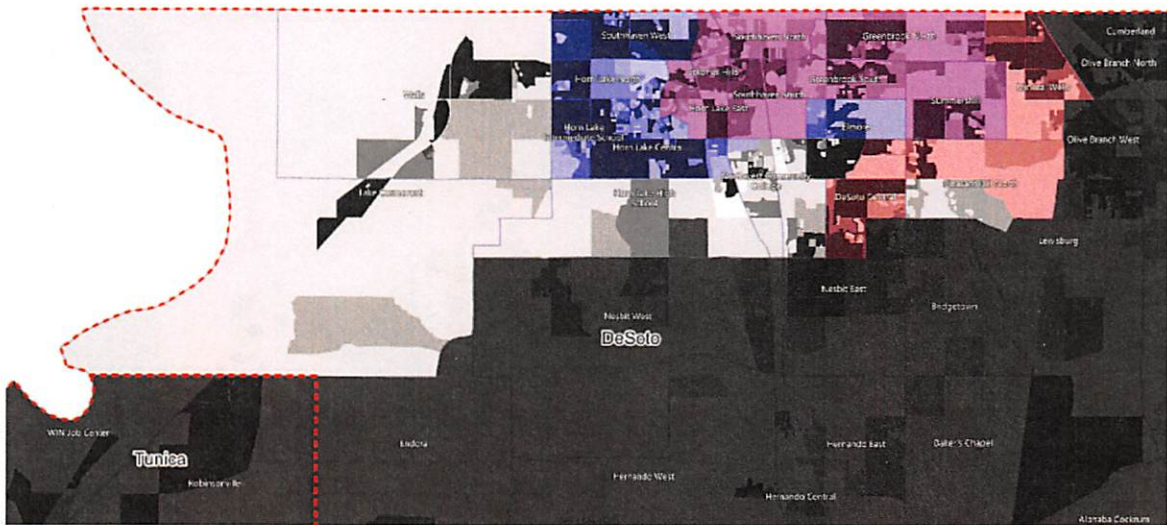

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HD #64 County Envelope (robustness check)

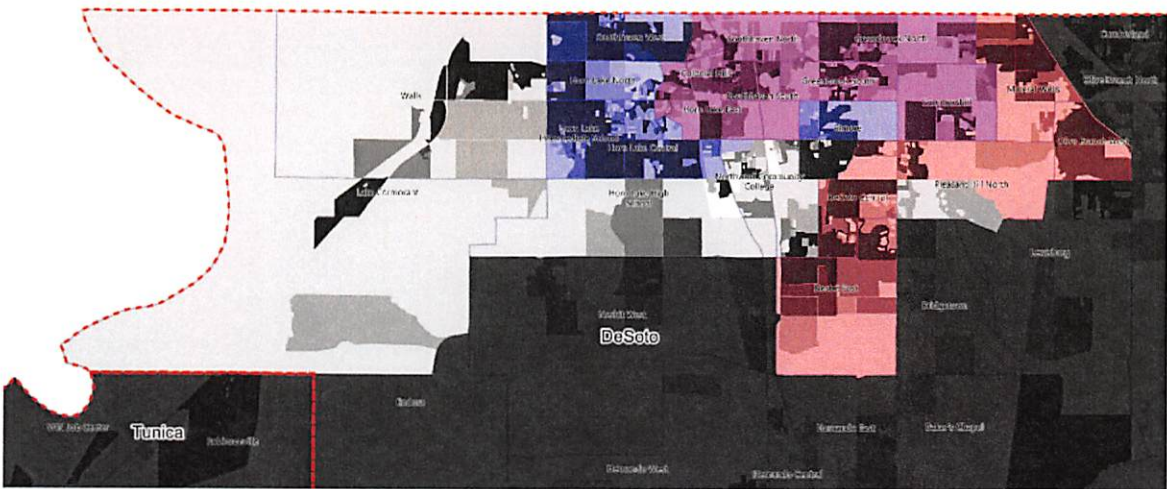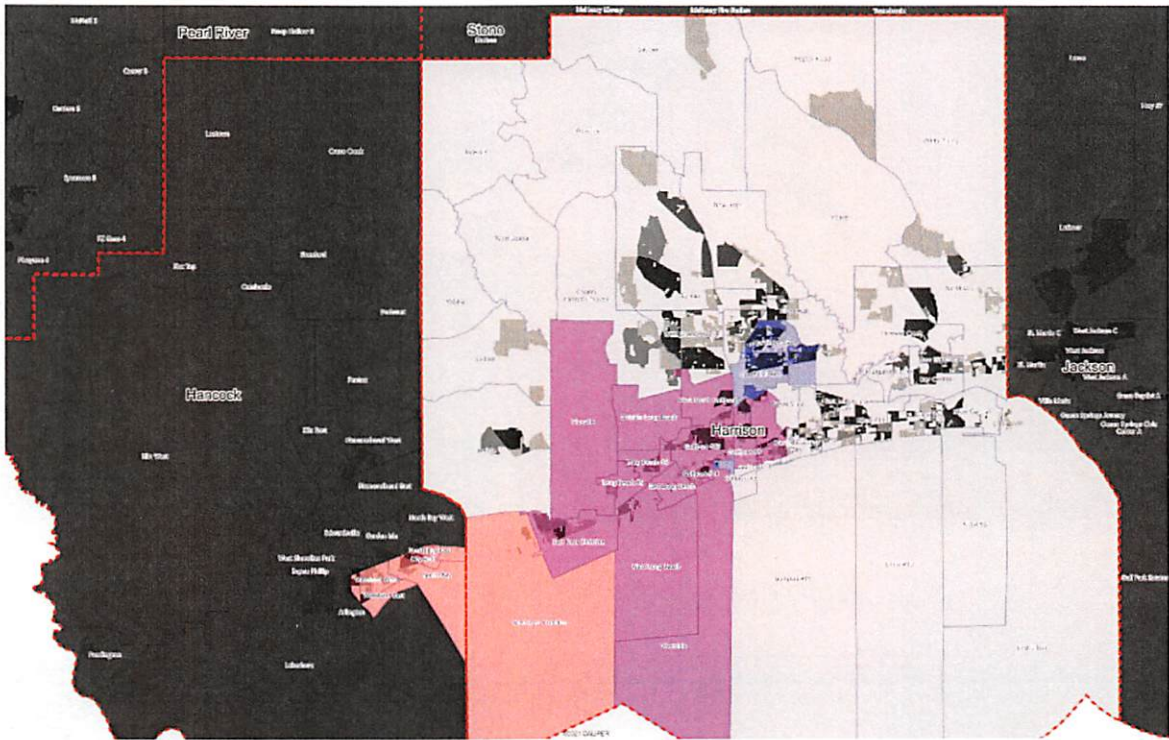
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SD #2 County Envelope (original report)

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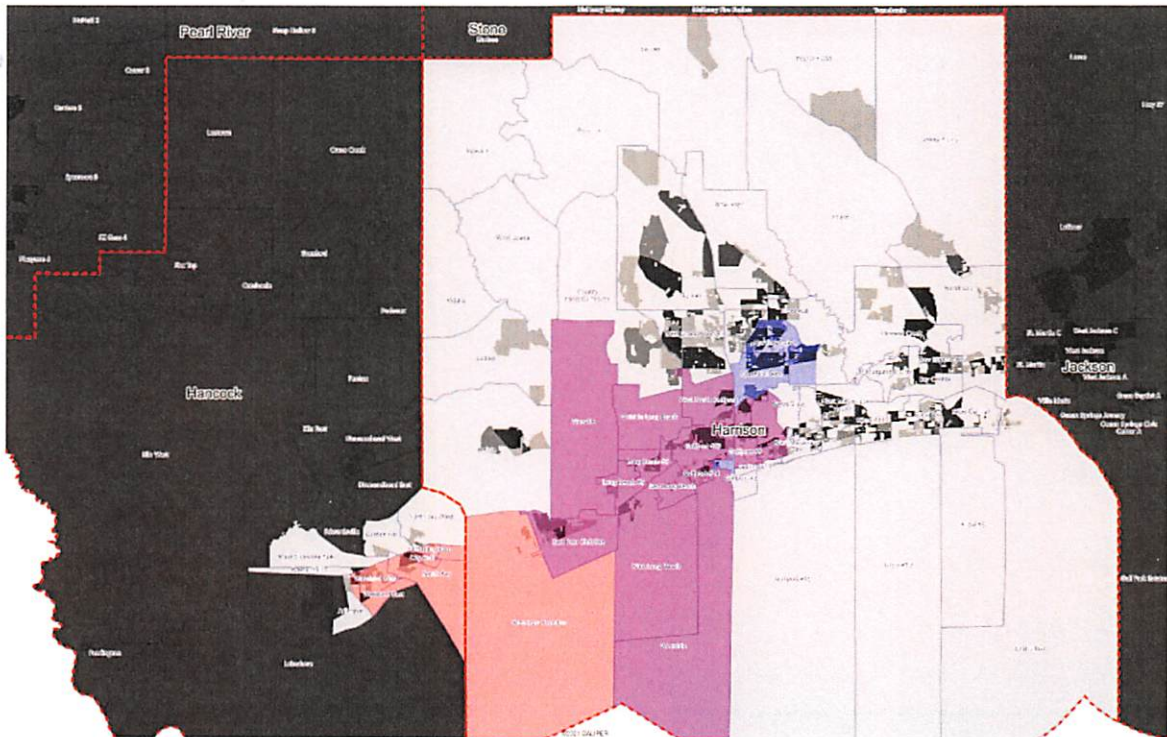*SD #2 County Envelope* (first robustness check)

SD #2 County Envelope (second robustness check)

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SD #48 County Envelope (original report)

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SD #48 County Envelope (robustness check)

I reserve the right to amend or supplement my report considering additional facts, testimony and/or materials that may come to light. Pursuant to 28 U.S.C. 1746, I declare under penalty of perjury that the foregoing is true and correct according to the best of my knowledge, information, and beliefs.

Dr. Jordan Ragusa
November 27, 2023
Charleston, South Carolina

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